Distance Learning at the Cleveland Museum of Art

Weather, Weather Everywhere

Grades 4-7

This Packet Includes:

Teacher Note:

- For the videoconference, please make copies of the blank **Water Cycle Worksheet** and **Cloud Identification Chart** included in the packet for each student.
- Also, please bring the materials for the **Cloud in a Bottle** activity described in this packet, if you would like to have the class make clouds during the program.

Teacher Information Guide:

Program Objectives:

Students will understand…

- The water cycle.
- How density of air affects weather.
- Weather changes due to pressure and temperature.
- Clouds consist of water vapor or ice crystals, depending on their altitude and other physical conditions.
- Different types of clouds are associated with different weather conditions, so visible changes in clouds alert one to oncoming weather systems.
- Cloud types, and their weather systems, have followed consistent patterns for centuries, as documented by both photography and by artwork that predates photography.

National Education Standards:

(This is a selection of the National Education Standards that align with this program – others may apply, as well.)

For Science (grades K-4):

Earth and Space Science

- Properties of earth materials
- Objects in the sky
- Changes in earth and sky

For Science (grades 5-8):

Earth and Space Science

- Structure of the earth system
  - Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
  - The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.
  - Clouds, formed by the condensation of water vapor, affect weather and climate.
  - Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
  - The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle

For Fine Arts - Visual Arts (grades K-4, 5-8):

- Making connections between visual arts and other disciplines.
- Choosing and evaluating a range of subject matter, symbols, and ideas

For Language Arts - English (grades K-12):

- Applying Knowledge
- Communication Skills
- Applying Knowledge
- Developing Research Skills
- Applying Language Skills

For Technology - (grades K-12):

- Basic Operations and Concepts
- Technology Productivity Tools
- Technology Communications Tools
- Technology Research Tools
- Technology Problem-solving and Decision-making Tools

For Social Sciences – Geography (grades K-12):

- Environment and Society

Prior to the Program:

- For the videoconference, please make copies of the blank **Water Cycle Worksheet** and **Cloud Identification Chart** included in the packet for each student.
- Also, please bring the materials for the **Cloud in a Bottle** activity described in this packet, if you would like to have the class make clouds during the program.

Weather Vocabulary:

Altitude – height as measured in the atmosphere.

Altocumulus – cumulus clouds at middle altitudes between 6,000 and 20,000 feet.

Altostratus – stratus clouds at middle altitudes between 6,000 and 20,000 feet.

Barometer – an instrument for measuring air pressure.

Collection (**accumulation**) – the process in which water pools in large bodies (like oceans, seas and lakes.)

Condensation – the process in which water vapor (a gas) in the air turns into liquid water. Condensing water forms clouds in the sky.

Cirrocumulus – cumulus clouds about 18,000 feet; may also be called “mackerel sky” because of their almost shiny silvery appearance, resembling the scales of a mackerel.

Cirrus – wispy clouds of ice crystals above 18,000 feet.

Cumulonimbus – cumulus clouds that can extend from near the ground to above 50,000 feet; thunderheads that often develop from towering cumulus, and bring thunderstorms.

Cumulus - white puffy clouds with distinct edges that sometimes look like cotton balls dotting a blue sky; sometimes have flat bottoms.

Density – mass divided by volume.

Dew Point – is the temperature at which water vapor can condense into liquid form.

Evaporation – the process in which liquid water becomes water vapor (a gas). Water vaporizes from the surfaces of oceans and lakes, from the surface of the land, and from melted snow in fields.

Fog – clouds so low they rest on the ground. Fog that forms in valleys and lowlands is known as radiation or ground fog and may leave the valleys fogged in all day, while the tops of the hills are clear.

Hydrologic – the study of water.

Humidity – refers to how much water vapor is in the air.

Precipitation – the process in which water (in the form of rain, snow, sleet, or hail) falls from clouds in the sky.

Relative humidity – the amount of water vapor in the air compared to the amount of water vapor the air can hold at a given temperature

Saturation – air reaches the point where it cannot hold any more water.

Stratocumulus – layered cumulus clouds below 6,000 feet

Stratus clouds – long clouds without distinct edges below 6,000 feet; create overcast days.

Tornado – rapidly rotating winds blowing around a small area of extreme low pressure that develops within a severe thunderstorm. Often visible as a funnel-shaped cloud, tornadoes can develop with little or no warning.

Transpiration – the process in which some water within plants evaporates into the atmosphere. Water is first absorbed by the plant's roots, then later exits by evaporating through pores in the plant.

During the Videoconference – Activities:

These activities may be done during the videoconference. The Cloud in a Bottle activity does require you to bring supplies for the class, which are listed below.

Shake to condensate:

Have students stand at least an arm's length from each other. While standing they can wiggle and move their arms up and down. When you say Evaporate, they can move about the room, but as soon as they touch someone they have to lock arms, they can still wiggle their free arms until they touch another person. Every 10 seconds the teacher can call out "you are higher in the atmosphere cool off and slow down, and take one step towards the center of the room". Continue until eventually all arms are locked together. At this point you can call them a cloud (s), and then say precipitate and everyone has to sit down. At this point you can illustrate how easy it was to move around when they were alone and "low in the atmosphere" with lots of energy, but as they got higher in the atmosphere they had to cool down, lose energy, move closer together and stick just like water molecules forming condensate.

Cloud in a Bottle:

Materials

- Inexpensive thin walled plastic water bottle
- Rubbing alcohol (isopropyl)
- funnel

Method

1. Empty the water bottle and remove the label.
2. Place approximately a ½ inch of isopropyl in the bottle and replace the cap.
3. Swirl the bottle around so the rubbing alcohol touches all parts of the inside of the bottle.
4. Quickly twist the bottle in half, around and around as if you were going to twist it apart.

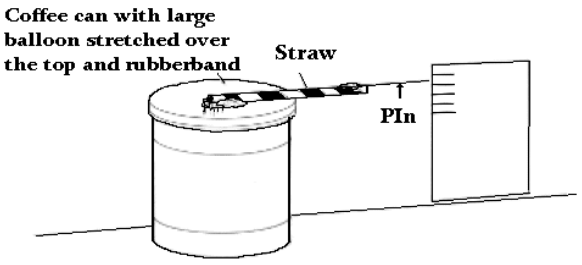
5. When the bottle is pressurized and feels like it is going to pop, quickly remove the cap and a cloud will form.
6. If it doesn't work here is a video http://www.youtube.com/watch?v=VNwZjkqd92Y

Explanation of why we used isopropyl and not water for the demonstration
Isopropyl alcohol has a lower boiling point than water and alcohol molecules have weaker bonds than water molecules that have very strong hydrogen bonds, so they break more easily. Consequently isopropyl evaporates more quickly than water. By twisting the bottle we increase the energy of the alcohol, as well as the pressure inside the bottle, causing the alcohol to vaporize. Since there are more evaporated alcohol molecules in the bottle, there are also more molecules able to condense. When we release the cap on the bottle there is a rapid decrease in both temperature and pressure causing the alcohol to condense and form a cloud.

Beyond the Videoconference – Teaching Extensions:

Make Your Own Barometer:

Materials: Coffee or soup Can, balloon, rubber band, pin, drinking straw tape/glue, paper.



With the lid off the can, stretch the balloon over the top and put the rubberband aroud it to help hold it in place. Tape or glue (not hot glue) the straw to the middle of the balloon, and the pin to the end of the straw. On the paper make an even scale, maybe copy the gradients on a ruler. Mark the spot where the pin is pointing, and check the weather report for the air pressure that day. As days go by check your barometer to see if the air pressure increases or decreases. You can check your results for accuracy by checking the weather report as well.

How does this day make you feel?

(Grades 4, 5, 6)
Using the art from the lesson, looking at a picture we can ask the students to write a response to questions such as: What does that day feel like? What are you doing on this day? Would you

want to be here right now, why or why not? How would the weather in this piece affect your mood or activities? What phase of the water cycle is represented here? What is the next phase? (Feel free to add in your own questions.)

Classroom Weather Station Instruments:

For a follow-up assignment, students can design simple meteorological instruments using common household materials, and construct a classroom weather station.

With a bit of patience, just a few dollars, and common household items (paper or plastic drinking cups, human hair, food coloring, drinking straws, modeling clay, masking or duct tape, scissors, etc.), students can build a fully equipped backyard or schoolyard weather station that—depending on how carefully and regularly measurements are made—can be surprisingly accurate. In addition to helping students become more aware of and observant of weather conditions on a daily basis, they may discover that conditions in their neighborhood's local microclimate actually differ significantly from those of the nearest official weather station—commonly an airport—just a few miles away.

There are several good websites with directions for building backyard weather stations. Check out more than one site, because they feature somewhat different instruments (you may want to mix and match), as well as different approaches to their construction.

Sites with directions and drawings suitable for upper elementary and middle school grades:

- The Franklin Institute in Philadelphia (http://www.fi.edu/weather/todo/todo.html) offers directions on making a **barometer** (for measuring air pressure), a **hygrometer** (for measuring humidity), a **rain gauge**, a **compass** and a **weather vane** (also called a weather cock or a wind vane), both for identifying wind direction. It also makes the valuable point that the most important part of the experimental apparatus is the **journal students keep of their observations**, advising that systematic measurements be made at least once per day at a regular time, and offering recommendations on what type of data to collect.

- The Center for Innovation in Engineering Science and Education (CIESE) site at http://www.k12science.org/curriculum/weatherproj2/en/activity1.shtml gives simple instructions for building a **weather vane**, a **rain gauge**, and a **barometer**. It also includes instructions for a do-it-yourself **thermometer** using rubbing alcohol and food coloring, and for an **anemometer** from paper drinking cups for measuring wind speed.

Suggested Reading:

For students....

Weisner, David. *Sector 7.* New York: Clarion Books. 1999.

Duncan, Jim. *The Weather Wizard's Cloud Book.* Chapel Hill: Algonquin Books. 1989.

Websites of Interest:

For students.....

- Test your cloud identification skills with these interactive weather games - http://eo.ucar.edu/webweather/

- Check out more clouds in art here - http://www.windows2universe.org/art_and_music/cloud_art/clouds_in_art.html

- Additional example photographs of clouds – especially useful for upper grades at - https://www.fin.ucar.edu/res/sites/imagelibrary/

For teachers....

- Teacher guide to clouds in art site - http://www.windows2universe.org/teacher_resources/teach_cloudart.html

- A cloud gallery of images free for teachers to use in presentations - http://www.carlwozniak.com/clouds/default.html

Distance Learning at the Cleveland Museum of Art
Weather, Weather Everywhere
Grades 4-7

Teacher Rubric:

Multimedia Project : Weather

Teacher Name: _____

Student Name: _____

CATEGORY	**4**	**3**	**2**	**1**
Content	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are 1-2 factual errors.	Content is minimal OR there are several factual errors.
Mechanics	No misspellings or grammatical errors.	Three or fewer misspellings and/or mechanical errors.	Four misspellings and/or grammatical errors.	More than 4 errors in spelling or grammar.
Oral Presentation	Interesting, well-rehearsed with smooth delivery that holds audience attention.	Relatively interesting, rehearsed with a fairly smooth delivery that usually holds audience attention.	Delivery not smooth, but able to hold audience attention most of the time.	Delivery not smooth and audience attention lost.

Selected images:

Distance Learning at the Cleveland Museum of Art
Weather, Weather Everywhere
Grades 4-7

Gray and Gold, John Rogers Cox**, 1942**
Oil on canvas
1943.60

The Secret Life, Rene Magritte**, 1928**
Oil on canvas
1992.298

Mojave Desert Clouds, Brett Weston***,* 1936**
gelatin silver print
1992.52

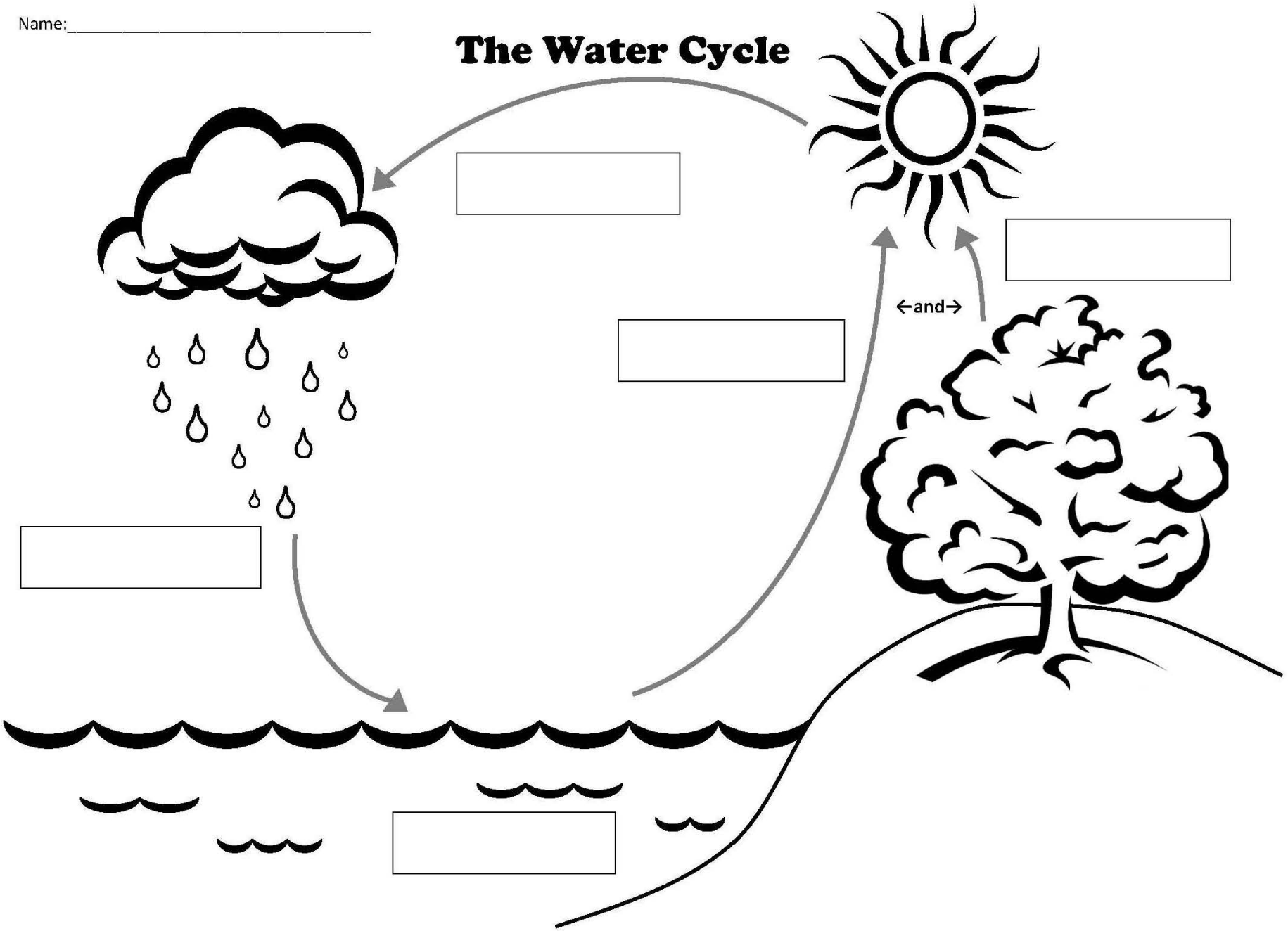
Twilight in the Wilderness, Frederic Edwin Church ***,* 1860**
Oil on canvas
1965.233

Untitled #102, Simen Johan, **2001 (printed 2004)**
Chromogenic process color print
2005.38

Stormy Weather, Kate Neufeld, **1943**
Linoleum cut
1943.239

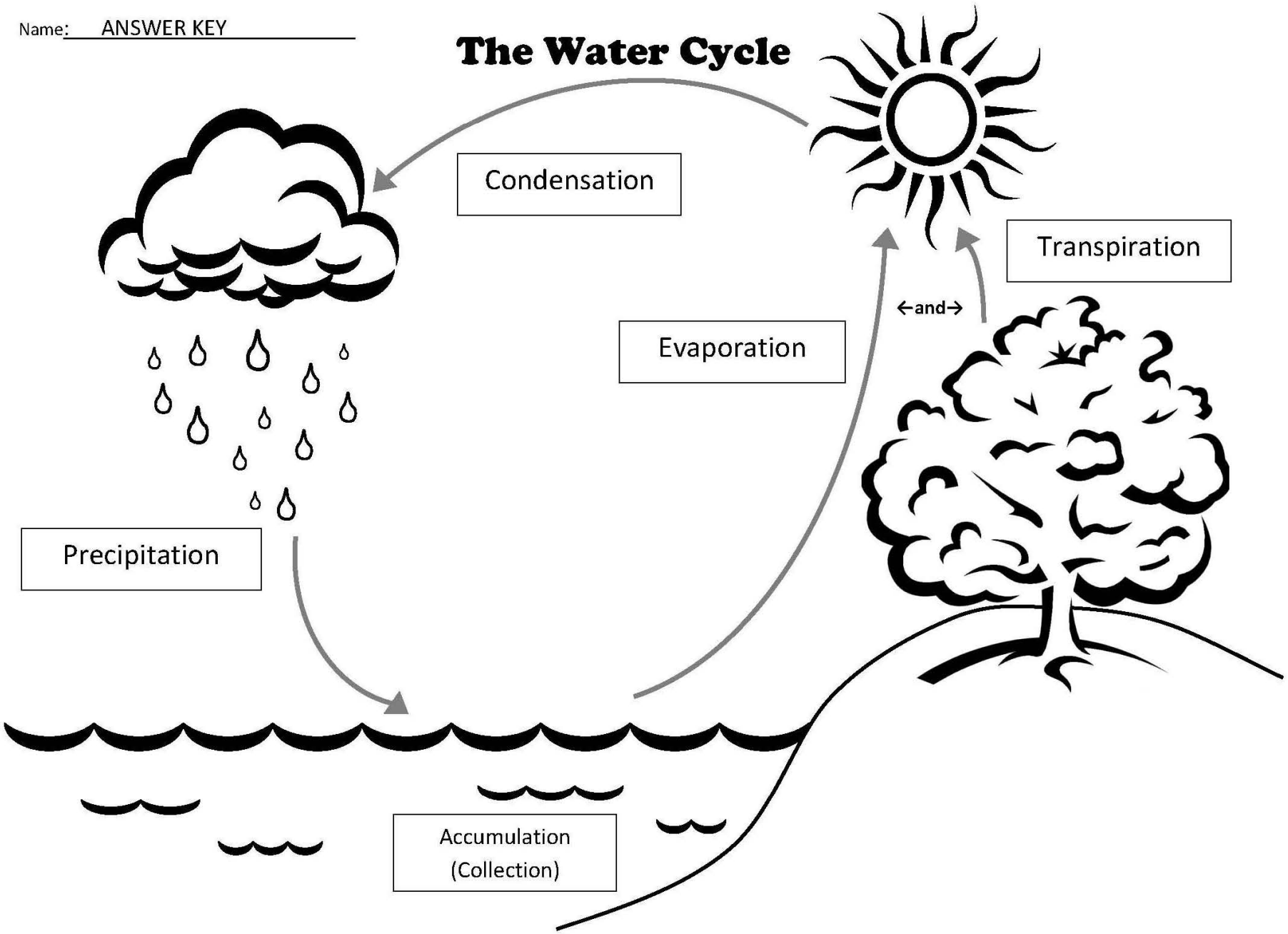
Name:_____

The Water Cycle



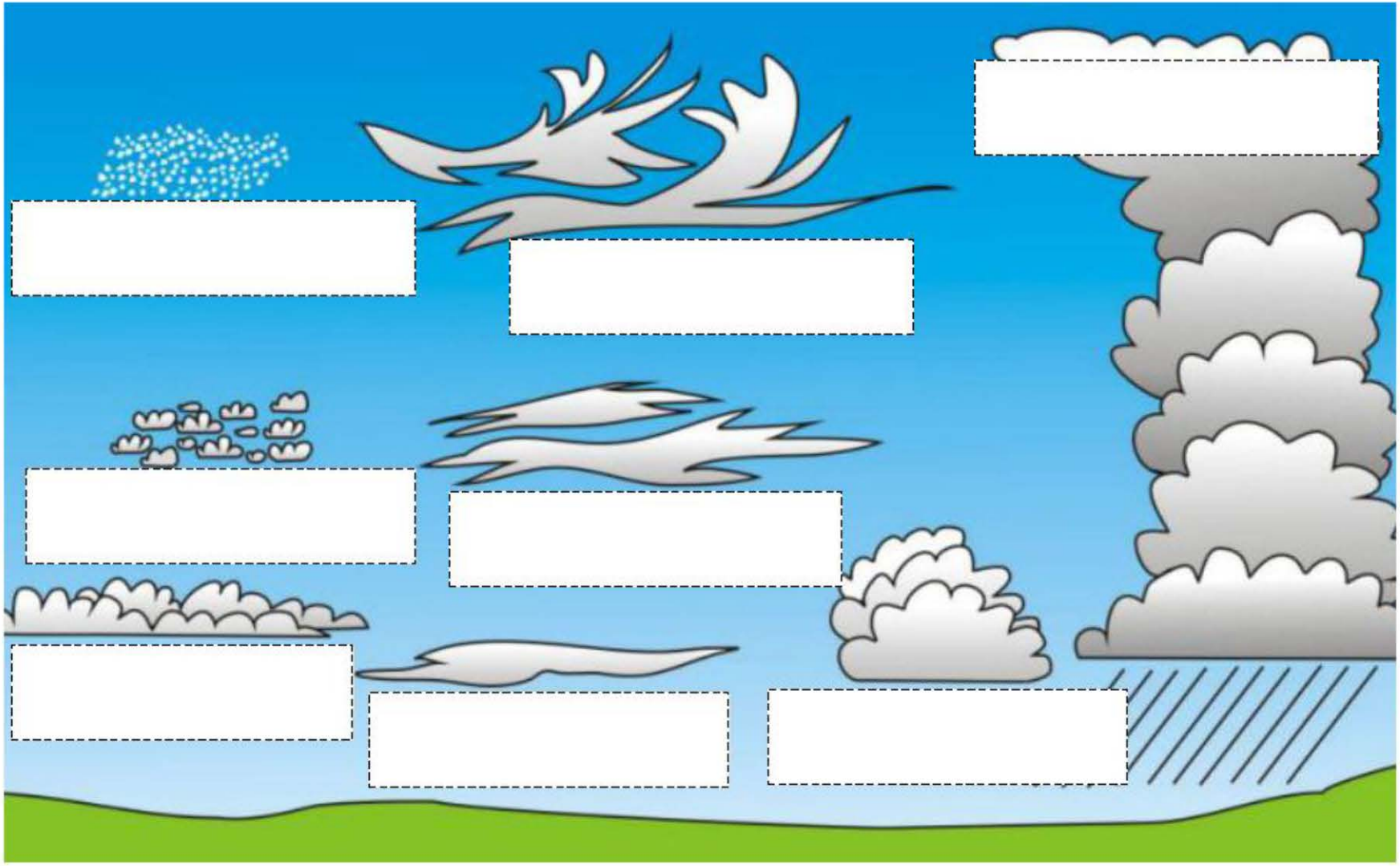
Name: ANSWER KEY

The Water Cycle



Name:_____

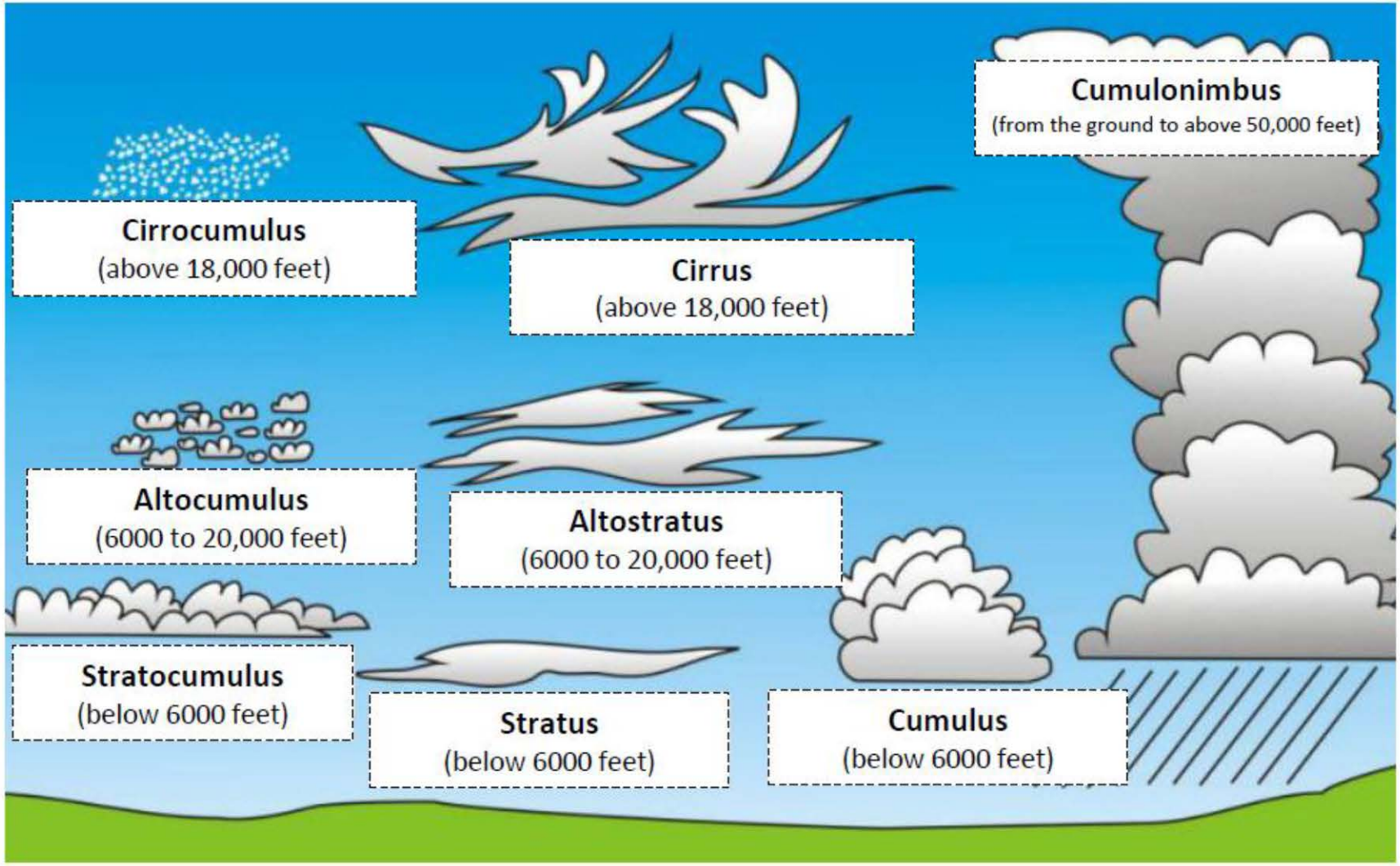
Cloud Identification Chart



Write the name and the average altitude (height) for each cloud.

Name: ANSWER KEY

Cloud Identification Chart – ANSWER KEY



Write the name and the average altitude (height) for each cloud.